U.S. ARMY TECHNICAL SAFETY CENTER FOR EXPLOSIVES SAFETY

EXPLOSIVES SAFETY BULLETIN

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The Department of Defense Explosives Safety Board

I expect that as you tackle your duties with ammunition and explosives, you frequently see memos or hear information about the Department of Defense Explosives Safety Board (DDESB). You may have met one of the Secretariat's Safety Engineers during your installation's periodic Explosives Safety Survey. Regardless of the circumstances that bring the DDESB into your world, I would like to briefly explain what the DDESB does, and why we do it.

The DDESB was established by Congress in 1928 as a result of the investigation stemming from the 1926 explosion at Lake Denmark, NJ. The DDESB's principal functions are to: a) advise the Secretary of Defense and the Service Secretaries on explosives safety matters; b) promulgate minimum explosives safety standards; c) review and approve explosives safety site plus unexploded ordnance clearance plans; d) conduct explosives safety surveys; and e) conduct an explosives safety research, development, and testing program.

The DDESB has a full time Chairman and professional Secretariat as well as part time voting members representing each Military Service. Additionally there are non-voting members representing the Joint Staff, Defense Logistics Agency, Defense Special Weapons Agency and other Commands. The Chairman and the Military Service Board members or their alternates make up the Board's corporate body. This group of five adjudicates all DDESB matters and by majority vote promulgates minimum explosives safety standards.

The Secretariat's primary function is to support the Chairman and the DDESB with unbiased technical advice on explosives safety technical and policy issues. The Secretariat is composed of four sections: 1) Military Representatives from the Military Services, to include the Marine Corps; 2) an Operations Directorate responsible for reviewing site plans and conducting explosives safety surveys; 3) a Technical Directorate responsible for drafting ammunition and explosives safety standards and conducting an explosives safety research, development and testing programs; and 4) an Administrative section.

The DDESB follows two basic principles in the deliberations surrounding policy decisions. Does the proposed change: 1) provide the maximum possible protection to personnel and property, both inside and outside the installation; and 2) limit the exposure to the minimum quantity of ammunition and explosives, consistent with safe and efficient operations? Test results and mishap data are considered, and operational issues are discussed; but as we are deciding minimum explosives safety standards, these are seldom the most significant factors in determining the final standard.

Probably the greatest likelihood of your becoming involved directly with the DDESB is through Explosives Safety Surveys. The frequency within CONUS is based on the type and tempo of ammunition and explosives operations. OCONUS surveys are done every other year. The purpose of the survey is to compare an installation's or facility's actual activities against those requirements contained in DOD Ammunition and Explosive Safety standards, DOD 6055.9-STD. We prefer the title survey because we spend just enough time on the installation to get an overview of explosives safety operations. Normally, we check via sample rather than inspect every magazine or operation. With more than 750 ammunition and explosives facilities and/or installations to survey and limited personnel, there is no way that we can perform detailed inspections.

Let me give you a few tips that can make the surveys easier for both you and us. First, have all the documents listed on the attachment to our survey notification memorandum readily available. Next, have all the appropriate personnel (installation safety manager, ammunition manager, QASAS, post engineer, range operations, explosive ordnance disposal, fire, etc.) at the in brief. A good explanation of your explosives safety program before we start really helps. The right people answering questions during the initial discussion can prevent misunderstandings later and allow us to focus on important issues early. Last, we always like to speak briefly with the Commander or Chief of Staff before we start and prior to departing. Commanders control resources and direct corrective actions. We feel that is vital that the Command Group hear not only what is wrong but what is right. Problems get fixed much faster, when the boss fully understands the potential consequences.

Please check out our Home Page at http://www.acq.osd.mil/ens/esb. We are still working on the page's contents but within six months we should have a valuable resource for explosives safety information. Please let us know items that we might incorporate on our home page that would be of interest to you.

POC is COL W. Richard Wright, Chairman, DDESB, DSN 221-0891

Protective Value of 12 Inch Reinforced Concrete Walls (RCW)

Twelve inch RCWs do not protect people from explosions as well as we thought they would. Current Army policy says they provide good protection for up to 15 pounds high explosive, but it simply is not true. We don't know

exactly how good they are yet, but until we find out you should look at any explosive operation where you are using a 12 inch RCW as an operational shield and reduce the amount of explosive behind it to the bare minimum. The U.S. Army Corps of Engineers (COE) is working to give us a more accurate calculation on how much explosive we can put behind a 12 inch RCW and still have it provide personnel protection. We should have that figure by 1 Oct 97. You may also want to consider the following options:

a. Move people farther away. If you can move back to public traffic route distance (K24) and provide protection from fragments, you can achieve the same protection the wall was supposed to provide. If you can't move them that far, any increase in distance will be better than none.

b. Stop the operation. If your production schedule permits, you may want to temporarily stop the operation until we get the COE data. Then you could start back up using the COE figure as the explosive limit.

c. Ask COE for help. The Huntsville Division of COE can help you boost the protection provided by a 12 inch RCW.

The current Army policy saying 12 inch RCWs are good for 15 pounds of high explosives is based on calculations made using formulas published in a pre-1990 version of TM 5-1300, *Structures to Resist the Effects of Accidental Explosions*. Those formulas considered the affect of the blast wave, but did not account for any contribution of gas pressure. Testing clearly shows the 12 inch wall will not protect people from 15 pounds of high explosive.

In November 1990, the TM formulas were revised to include the effects of gas pressure as well as blast. Using these formulas from the new TM, the COE, Huntsville Division, determined that one type of 12 inch RCW it analyzed could provide category 1 personnel protection for only about 1 pound of explosives. The COE said that the reaction of a wall depends primarily on the size and placement of reinforcing bars and not necessarily on the thickness of the wall. Because of this the reaction of other 12 inch RCWs may be different, but it does illustrate the difference in result for the two sets of formulas. The COE believes the new formulas under value the RCW while the old ones over-valued it and that the true protective value lies somewhere in between (i.e., in between 1 pound and 15 pounds).

To resolve this dilemma we asked the COE for help. They developed even newer formulas which they think better predict how a wall will react to an explosion. When they apply those new formulas to several types of 12 inch RCWs, it should give us the number of pounds of high explosive for which the wall can provide personnel protection. We expect to have that number by 1 Oct 97. When we get it, we will pass it along to you and suggest the Army policy be changed.

POC is BG Arbuckle, AMCAM, DSN 767-8021

Why So Hazardous?

What is it that makes ammunition and explosives so different from other hazardous materials? Is it the stored energy? When you look at stored energy in the form of calories, benzene, a key component of gasoline, contains 10,101 calories per gram. A gram of TNT contains 1,080 calories. The reason that TNT is so much more dangerous is that its energy is released at once, while the energy in benzene is released over a period of time. This sudden release of energy will produce blast and over pressures which can and will result in injuries and possibly death.

POC is Mr. Greg Magerl, SIOAC-EST, DSN 585-8743.

Lessons We Refuse To Learn

Since April 1992 the Army has suffered three (3) deaths and one serious disabling injury during demolition training exercises. In all cases the personnel failed to take cover in a missile proof shelter or withdraw to the distances specified in AR 385-63, Policies and Procedures for Firing Ammunition for Training, Target Practice and Combat.

Personnel must be aware that steel cutting, cratering charges and charges placed on concrete can throw fragments and debris for a tremendous distance and in a high arc. Fragments that are projected in a high arc can hit personnel taking shelter behind berms or vehicles. A second aspect that needs to be controlled is the WHOOAH factor. For example, if 4 lbs of C-4 explosives are needed to cut an I-beam, then 6 or 7 lbs of explosives would do it better, make a bigger noise and that would be WHOOAH. The increased amount of explosives to achieve WHOOAH will throw fragments further. Personnel should demonstrate greater skill by using the minimum amount of explosives needed to complete the mission. WHOOAH was involved in at least two (2) of the incidents mentioned above.

POC is Mr. Greg Heles, Logistics Management Specialist, DSN 585-8877.

Static Advisory - Extended Cold Weather Clothing System (ECWCS)

Soldiers conducting static-sensitive operations need to be aware of possible static discharge from the ECWCS parka, NSN 8415-01-228-1306 (series) and trousers, NSN 8415-01-228-1336 (series).

These outer garments of the ECWCS are made of a synthetic laminated cloth (commonly known as Gore-Tex). These synthetic materials can develop a static electric charge that does not readily dissipate. Synthetic fabrics generally

develop greater static charges and maintain these charges for a longer period than natural fibers such as cotton or wool.

Electrostatic discharge (ESD) during operations such as ammunition or missile handling, fuel dispensing and refueling, and maintenance of electronics may present an immediate operator hazard or a delayed adverse effect upon systems.

Units should identify operations where ESD can be a hazard and implement controls to reduce or eliminate these hazards. References that specify established procedures include, but are not limited to, the following:

o FM 10-68: Aircraft Refueling

o FM 10-69: Petroleum Supply Point Equipment and Operations

o FM 10-20: Organizational Maintenance of Military Petroleum Pipelines, Tanks, and Related Equipment

o FM 9-38: Conventional Ammo Unit Operations

Fortunately, no incidents have been attributed to ESD from field clothing, however, units should ensure normal engineering controls, such as grounding, bonding, and ventilation of fuel/air mixtures are part of their standing operating procedures for static sensitive operations.

Technical POC is Mr. Neil E. Smedstadt, U.S. Army Natick Research, Development and Engineering Center, DSN 256-4032 (Comml 508-233-4032). Safety POC is Mr. Paul G. Angelis, U.S. Army Soldier Systems Command, DSN 256-5208 (Comml 508-233-5208).

Poison Plants

Maintenance and vegetation control in ammunition areas have many aspects that can cause bodily harm. One often overlooked area is the nature of the plants themselves. Poison ivy, poison oak, and poison sumac are the three most common urushiol oil (pronounced oo-roo-she-all) containing plants in this country. Each year they cause almost two million cases of a dermatitis that can be extremely distressing. Urushiol poisoning is the greatest single cause of Worker's Compensation claims in the U.S. and is a leading cause of disabling dermatitis. Only about one percent of the U.S. population is totally immune. These thought-to-be favored people must also take precautions: Body metabolism may change without warning, and they may become vulnerable to the effects of these plants.

A reaction to urushiol begins with itchiness and some swelling. This is followed by a pink inflammation of pimple-like blisters. These blisters grow larger and couple in chain-like reactions. Rarely is the tough, thick skin of the palms, the soles, or the scalp affected. A clear fluid oozes from the blisters and forms a yellow crust. This oozing fluid can transport oil from an area that has not been cleaned properly to an unaffected area, and spread the irritation. In minor cases the rash lasts ten to twelve days. In severe cases it can last thirty days or more. Any case that lasts over ten days, or if the affected area is larger than the persons hand, or where the affected area is around the eyes, mouth, nose, genitals, or rectum should be seen by a physician.

In instances where contact with urushiol bearing plants cannot be avoided, the worker must take extreme precautions to prevent direct or indirect contamination. Ordinary work trousers tied at the boot mouth, a long sleeved shirt and gauntlet type gloves will usually protect against direct contamination of the skin, but protection against indirect contamination requires great vigilance. A casual wipe of a contaminated glove against the head can cause the characteristic rash and a breath of smoke from burning urushiol-containing trash can inflame the mouth, nose, throat and lungs. Clothing and tools can remain contaminated for years after being in contact with a urushiol producing plant. Washing contaminated clothing and contaminated surfaces with copious amounts of cold water is the easiest way to get rid of urushiol. Use a degreasing detergent, wear rubber boots and gloves when washing tools. Any water that contains urushiol should not be used to wash other items, and should be disposed of where others cannot come into contact with the oil. Over the years, many old-wives-tales have been handed down on treatment of these infections. Rubbing with banana skins, paste made from yellow soap, salves, lotions, sprays, even bleach have been used. To date, there is NO MIRACLE CURE, but temporary relief of that troublesome itch is possible. Blotting the area dry and applying an anti-pruritic lotion will help. There are other things that can help prevent infection. Rubbing your body with cold cream before working around these plants may help. The urushiol will attach to the cold cream and can be washed off more easily. The oil can penetrate the cold cream so infection is still possible. There are creams made for the prevention of urushiol infection, these creams do help. One such cream is "Tecnu Oak-N-Ivy Armor*". Another way to prevent infection by these plants, is by use of homeopathic drugs. These drugs are small doses of urushiol taken over time to build temporary immunity. One such drug is called "Oral-Ivy*" and can be purchased over the counter at many pharmacies.

Working in many ammunition storage areas these plants can be found in abundance. By remembering these tips for working around these plants, the seasonal changes and avoiding contact with the plant; you have a chance of staying rash free. Keep an eye open for the three heart-shaped leaves, hairy vines, white flowers, and milk-colored berries---you may avoid hours of itching.

POC is Mr. Jimmy L. Langley, Occupational Health and Safety Specialist, DSN 585-8767.

Check Your Mask!

DA Pam 385-61, Toxic Chemical Agent Safety Standards, Chapter 4, Personnel Protective Clothing and Equipment, paragraph 4.4e(4) "Individual care. Each individual is responsivle to maintain his or her own mask. This includes a detailed visual inspection. Defects will be immediately reported to the supervisor." This paragraph directs that if you are issued a protective chemical mask (M9, M17, or M40 series) you must check it for defects at the beginning of each shift. Here is a list of some of the items you should check:

* Check canister (M9 and M40 series) around seams, for cracks, dents, or holes.
* Check air intake to make sure it is not clogged.
* Shake mask and listen for loose absorbent particles broken loose from filters.
* Check eye lenses for cracks, cuts, scratches, or discoloration that affects vision.
* Check rubber around eye lenses for tears, looseness, brittle spots, soft or sticky spots, or cracked rims.
* Check inside surfaces of face piece for dirt, mud, body oils, or any greasy substance.
* Check face piece for holes, tears, and splits by holding in front of a light source. Check the edges closely. Check for soft or sticky spots.
* Check head harness for loss of elasticity. Check straps for cuts, tears, missing parts, fraying or deterioration.
* Check buckles for bends, cracks, chips or scratches. Look for any missing or broken buckles.
* Put mask on and check inlet and outlet valves (clear and seal).

If any of these defects are noted, report to the supervisor at once. Your mask is an important piece of equipment. Your very life could depend on it functioning properly. Check these items before you need it.

POC is Mr. Jimmy L. Langley, Safety and Occupational Health Specialist, DSN 585-8767.

Mini-Magazine for Ammunition

The U.S. Army Engineer Division, Huntsville, developed a Technical Data Package (TDP) that provided complete construction documents for two magazines: one with a main compartment capacity of 150 pounds and the other with a main compartment capacity of 400 pounds. The first mini-magazine is limited to a total capacity of 150 pounds NEW of HD 1.1 explosives; 100 pounds in the main compartment and 25 pounds in each of the side compartments. The second mini-magazine is limited to a total capacity of 400 pounds NEW of hazard class/division (HCD) 1.1 explosives; 300 pounds in the main compartment and 50 pounds in each of the side compartments. Although munitions of incompatible storage groups are not typically stored together in magazines due to safety concerns, the unique compartmentalized designs described by the TDP allows for such storage. Maximum allowable net explosive limits are presented in the TDP. The mini-magazine designs have been reviewed and approved by the U.S. Army Technical Center for Explosives Safety (USATCES) and by the Department of Defense Explosives Safety Board (DDESB).

The mini-magazine designs offer several advantages over conventional magazine designs. Using approved analytical techniques, QDs required for fragmentation have been reduced by as much as 85% from those required for conventional magazines. Frequently, use of a mini-magazine allows siting at prescribed default distances required by DoD 6055.9-STD, "DoD Ammunition and Explosive Safety Standards", for over pressure. The separate compartments incorporated in the mini-magazine designs allow storage of incompatible munitions within the mini-magazine. Mini-magazines can store all HD, including small quantities of HD 1.2. Mini-magazines utilize standard reinforced concrete design versus laced reinforcement design which widens the bid pool of capable construction contractors. The construction cost of mini-magazines is less than conventional magazines or of several small magazines capable of the same performance as mini-magazines. There is a potential for dollar savings and other site benefits resulting from less encumbered real estate. In addition, there is decreased environmental impact due to reduced hazard zones affecting real estate.

The need for the mini-magazines comes from DoD ammunition manufacturing and Load, Assembly, and Packaging (LAP) plants, research and development laboratories, testing activities, explosive ordnance units, security forces, surveillance workshops, demolition operations, early entry units, and theater ammunition units. These organizations often have a requirement to store small quantities of various classes of munitions in populated areas or locations with limited open space. To satisfy safety criteria, for HCD 1.1, the default Inhabited Building Distance (IBD) is 670 feet for quantities less than or equal to 100 pounds Net Explosive Weight (NEW) and 1250 feet for quantities greater than 100 NEW. This requirement often forces Army units and installations to store explosives at remote locations affecting readiness and productivity, or store under waiver in violation of QD safety criteria.

Mini-magazines described by the TDP are intended for use in all ammunition or explosives storage environments, in CONUS and OCONUS. The advantages of the mini-magazine designs are best realized in areas with limited unencumbered real estate. The mini-magazine are most

advantageous where explosives QD restrictions preclude construction of typical standard magazines. The 150 pound mini-magazine consists of a 7' wide x 8' long x 7' high main compartment and two 4' wide x 4' long x 4' high secondary compartments. A minimum of 2 feet of earth cover is required for the 150 pound mini-magazine to limit fragment dispersion to distances below IBD requirements. The 400 pound mini-magazine consists of a 14' wide x 14' long x 8' high main compartment and two 4' wide x 4' long x 6' high secondary compartments. A minimum of 3 feet of earth cover is required for the 400 pound mini-magazine to limit fragment dispersion to distances below IBD requirements. To minimize real estate usage and construction costs, a concrete retaining wall was selected to retain the earth fill of each mini-magazine. A barricade is required in front of each mini-magazine to intercept the door and other fragments. A concrete canopy is required between each mini-magazine and its barricade for additional protection from fragments and HCD 1.2 munitions "kick-out". Standard reinforced concrete construction (as opposed to laced reinforced) is utilized in the mini-magazine designs. The lifetime of these structures is 25 years minimum. The soil covering over the magazine should be periodically inspected and restored to original condition as necessary. No lightning protection is required.

Mini-magazines are currently in the process of becoming a standard design to be maintained by the U.S. Army Corps of Engineers and contained in EP 1110-345-2, Engineering and Design Index of Design Drawings for Military Construction.

A copy of the mini-magazine TDP which contains construction information, construction techniques, bill of materials, and procurement/requisition information, may be obtained from the following address: Director, U.S. Army Technical Center for Explosives Safety, SIOAC-EST, Savanna, IL. 61074-9639.

POC is Mr. Robert H. Davidson, DSN 585-8627 or commercial (815) 273-8627.

Geosynthetic Reinforced Barricades for Ammunition Storage

There are three different types of geosynthetically reinforced barricades; double-faced geotextile wall, geotextile-wrapped sandbag wall, and the geocell wall. All three barricades use sandy soil as backfill. These barricades are accepted by DoD explosive safety regulations and are intended to be an improvement to ordinary sandbag walls. A siteplan is required prior to building one of these barricades.

Geosynthetic walls provide significant advantages over ordinary sandbag barricades, typically built to protect and separate ammunition. Geosynthetic walls are up to 3 times cheaper, can be built up to 8 times quicker, the construction material takes up to 8 times less storage room, and may last 10 to 40 times longer. Because the walls can be built with near vertical slopes, they require less ground space and less backfill soil than embankment barricades.

The walls can be quickly built using troop labor. The addition of a front end loader will facilitate construction. Notching of the geocell (or sand grid) will interlock layers of geocell in their right position. A power operated band saw may be required to trim and notch geocell material. The rough cost of the geosynthetic material to build a 6 feet high, 3 feet wide by 20 feet long wall is between $100.00 to $600.00.

The geosynthetic walls may be used as barricades in storage areas to separate stacks of ammunition. The length and height of the barricades built shall comply with the requirements specified in Chapter 5, Section C of Army Regulation (AR) 385-64. All designs must have at least a three feet crown. The 1.5 (horizontal) to 1 (vertical) slope requirement as contained in AR 385-64 is not required for these barricades since they possess adequate erosion control and are stable. Painting of the exposed portions of the two type geotextile walls is essential for longevity.

POC is Mr. Robert H. Davidson, DSN 585-8627.

A copy of the Safeload Program Technical Data Package titled "Geosynthetic Reinforced Barricades for Ammunition Storage" may be obtained by a request to: Director, U.S. Army Technical Center for Explosives Safety, SIOAC-EST, Savanna, IL 61074-9639.

FUDS Safety Submissions

The Army Safety Office has requested and USATCES has temporarily assumed Army responsibility for final review and approval of OE safety submissions for formerly used defense sites (FUDS).

POC is Mr. Melvin Colberg, Chief, ESL, DSN 585-8801, Commercial 815-273-8801.

Glazing in Ammunition and Explosives Structures

Draft DA PAM 385-64, Ammunition and Explosives Safety Standards, paragraph 8-2a(1) contains a requirement for new or modified buildings to have a glass breakage personnel hazard risk assessment. This requirement had been in the draft since the first versions, and is a sort of descendent of the old AMC requirement for non-shatterable glazing in explosives facilities.

Recently, the Department of Defense Explosives Safety Board (DDESB) held up the final approval of a site plan for a slightly modified facility pending receipt of the cited assessment. In discussing the intent of the requirement with

DDESB personnel, we learned that injuries due to glass breakage concern the Board. Experience in the international private sector, where buildings have been attacked by terrorists, heightens these concerns. In these attacks, even though the blasts severely damage structural elements, it was often the glass breakage and flying glass shards that caused the most serious injuries. As a result, the DDESB is requiring that all new plans reaching them for approval address this subject.

Safety regulations and technical manual address the degree of damage anticipated in buildings located between the potential explosion site and inhabited building distance. The closer to the explosion, of course, the greater the degree of damage. The fact that structural damage will occur should not overshadow the need to consider the effects of glass breakage. While the Draft DA PAM does not provide specific guidance for glass breakage analysis or response, these general factors/conditions apply:

a. No glazing is the ideal. All glazing in buildings containing or exposed to explosives should be of non-shatterable materials or design. Window glass with embedded "chicken wire" does not materially improve safety from fragments. Removal of existing windows and structural replacement is an option.

b. When glazing is present, personnel should be as far from the glazing as practical, or otherwise protected. Several means of protection exist. In all cases, the anticipated incident over pressures will impact the application and the design specifics of the application.

(1) Installations can apply special films to window glass to improve its resistance to shattering. Some films are effective to several pounds per square inch of explosive over pressure.

(2) Installations can use non-shatterable glazing of a polycarbonate or other substantial type in lieu of window glass. A key feature in such installations is to secure the glazing effectively. True effectiveness generally requires that the frames hold the glazing more effectively than is traditional for window glass.

(3) Installations can install internal wire screens to retain glass fragments.

The POC is Mr. Glenn Leach, AMSIO-DMS, DSN 793-2554, e-mail amsio-dms @ria -emh2. army.mil

Somethings Old, Somethings New

By now you should have noticed that there has been some change to the format of this explosives safety bulletin. There are two articles that are not strictly explosives safety. These changes came about because of changes within the Technical Center. First, the old editor received a temporary promotion and was moved to another office. Our best wishes for her success go with her. The second change was that because of this move and loss of spaces, a decision was made that this bulletin would no longer be published. Well, we the people who write the articles felt that this was an important method of getting news to people - just ask the person whose phone is ringing off the hook after publication. So, we decided that we would take over the effort of writing and editing the bulletin. In doing this a change in content was decided on. We looked at what we are doing and how it is affected by the area of general safety. A decision was made to try to address concerns which may affect people who work in the arena of explosives safety, but are not completely explosives safety. This resulted in the article on poisonous plants. Third, we decided that the scope should be changed and guest writers should be published in the bulletin. In this bulletin Col Wright, who is the Chairman of the DDESB, wrote the article about the DDESB. This is being done to expand the knowledge of the explosives safety community and try to bring some understanding about why things are the way they are. Finally, we want to hear from you. This publishing of guest articles - we hope - will include articles from contractors, other services, and from members of services other than the U.S. Armed Forces.

We hope that you will give us feedback on how you feel about the new approach being taken.

POC is Mr. Gregory Magerl, Logistics Management Specialist, DSN 585-8743, Commercial 815-273-8743. E-mail: magerl/dac@dac-emh1.army.mil